Rescuing historical weather observations improves quantification of severe windstorm risks

Ed Hawkins[1], Philip Brohan[2], Samantha N. Burgess[3], Stephen Burt[1], Gilbert P. Compo[4,5], Ivan D. Haigh[6], Hans Hersbach[3], Kiki Kuijjer[6], Chesley McColl[4,5], Suzanne L. Gray[7], Oscar Martínez-Alvarado[1,7], Andrew P. Schurer[8], Laura Slivinski[4,5], Joanne Williams[9]

[1] National Centre for Atmospheric Science, Department of Meteorology, University of Reading, Reading
[2] Met Office Hadley Centre, Exeter
[3] Copernicus Climate Change Service, ECMWF, Reading
[4] Cooperative Institute for Research in Environmental Sciences, University of Colorado at Boulder
[5] NOAA Physical Sciences Laboratory, Boulder
[6] School of Ocean and Earth Science, National Oceanography Centre, University of Southampton, Southampton
[7] Department of Meteorology, University of Reading, Reading
[8] School of Geosciences, University of Edinburgh, Edinburgh
[9] National Oceanography Centre, Liverpool

Correspondence to: Ed Hawkins (ed.hawkins@ncas.ac.uk)

Supplementary Figures

Figures S1-S6 illustrate the temporal evolution of Storm Ulysses in 20CRv3 and the two experimental versions of the reanalysis for key variables – mean sea level pressure (Figure S1), wet bulb potential temperature at 850mb (Figure S2), relative humidity with respect to ice at 700mb (Figure S3), wind speed at 850mb (Figure S4), ensemble likelihood of wind speed at 850mb above 38ms⁻¹ (Figure S5) and precipitation (Figure S6). All these figures use the ensemble mean, except for Figure S5 which shows the fraction of ensemble members above the wind threshold at each time. In the two reanalysis experiments, the features are sharper and more pronounced, with the severity of the storm increasing, compared to the original 20CRv3.
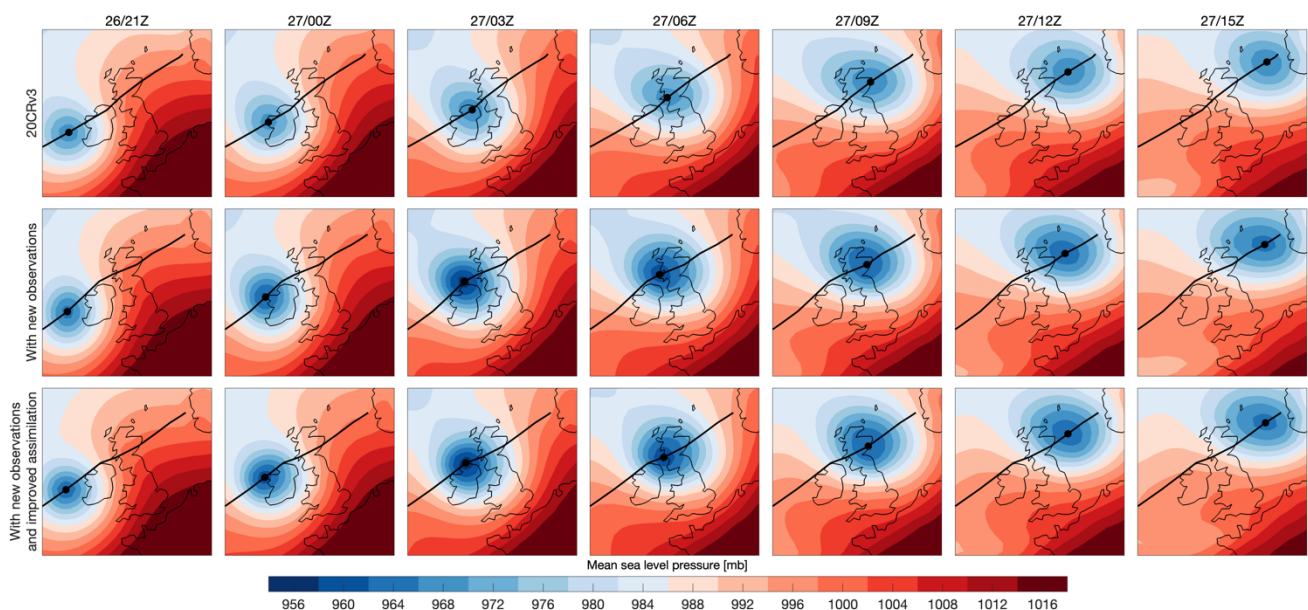
Figure S1: mean sea level pressure during Storm Ulysses (ensemble mean). The storm track is shown by the black line with solid circle representing the centre of the low pressure.
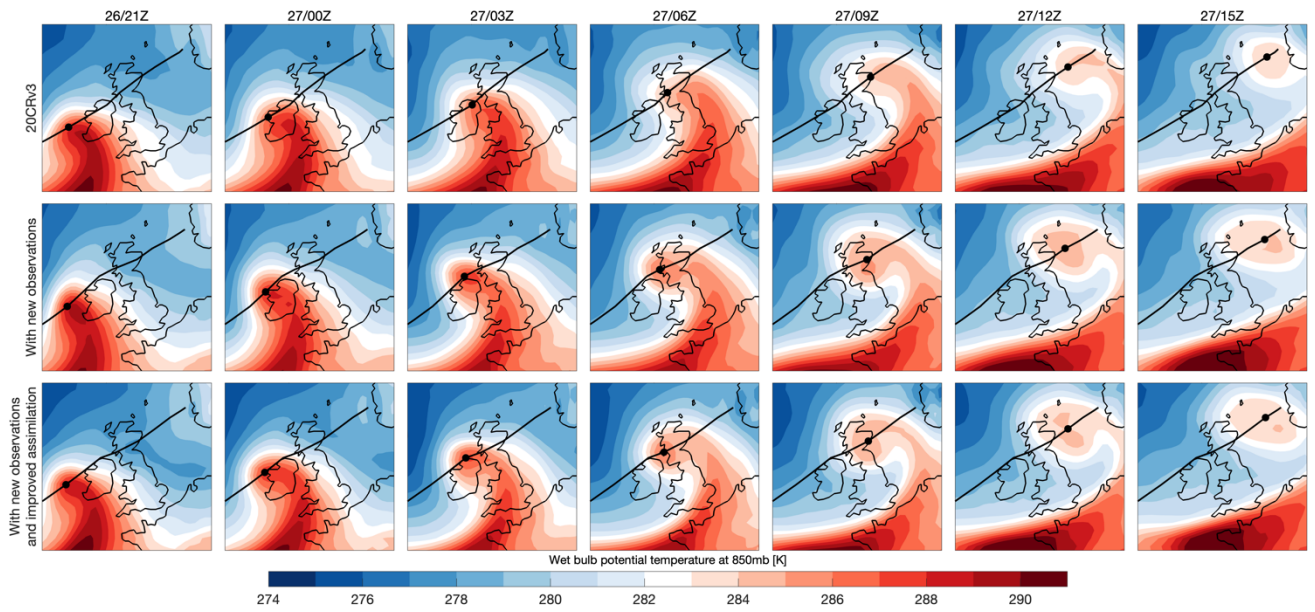
Figure S2: wet bulb potential temperature at 850mb during Storm Ulysses (ensemble mean). The storm track is shown by the black line with solid circle representing the centre of the low pressure.
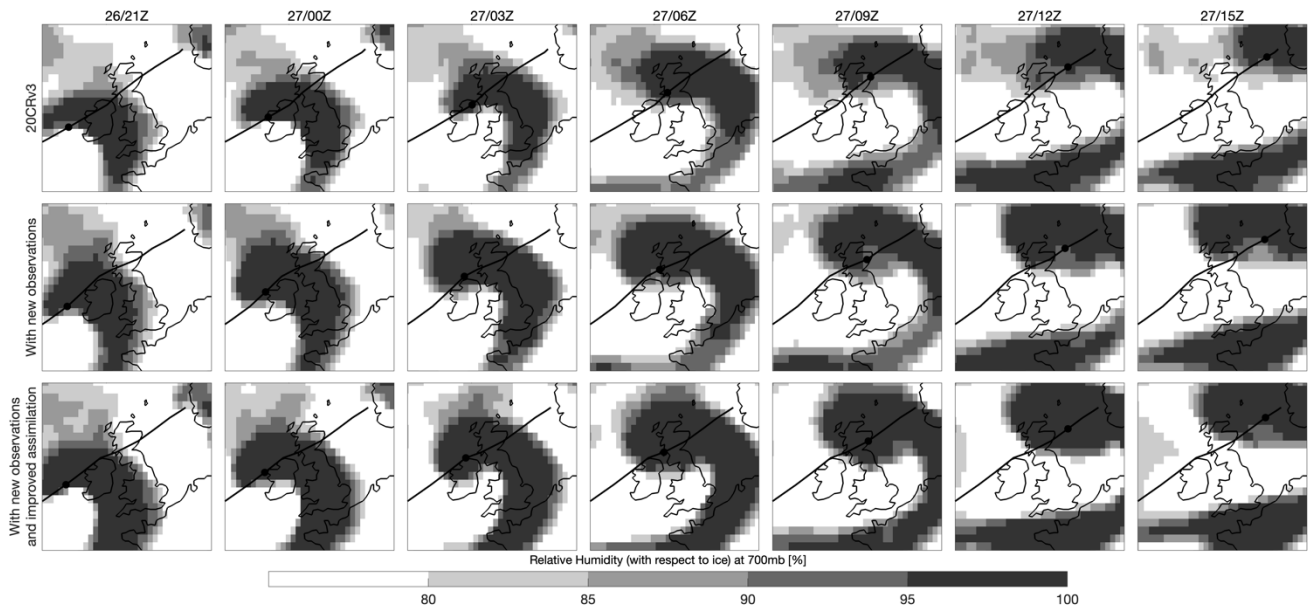
Figure S3: relative humidity with respect to ice at 700mb during Storm Ulysses (ensemble mean). Values above 80% roughly denote the cloud head of the storm. The storm track is shown by the black line with solid circle representing the centre of the low pressure.
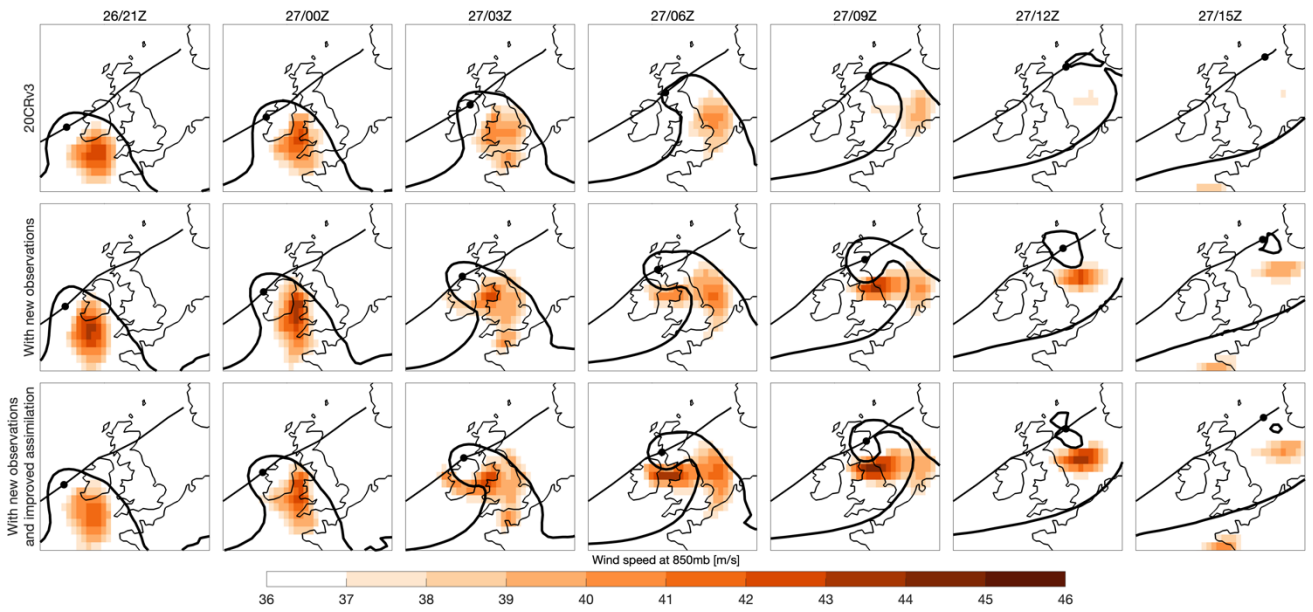
Figure S4: wind speed at 850mb during Storm Ulysses (ensemble mean). The black contour is the 284K wet bulb temperature isotherm at 850mb. The storm track is shown by the black line with solid circle representing the centre of the low pressure.
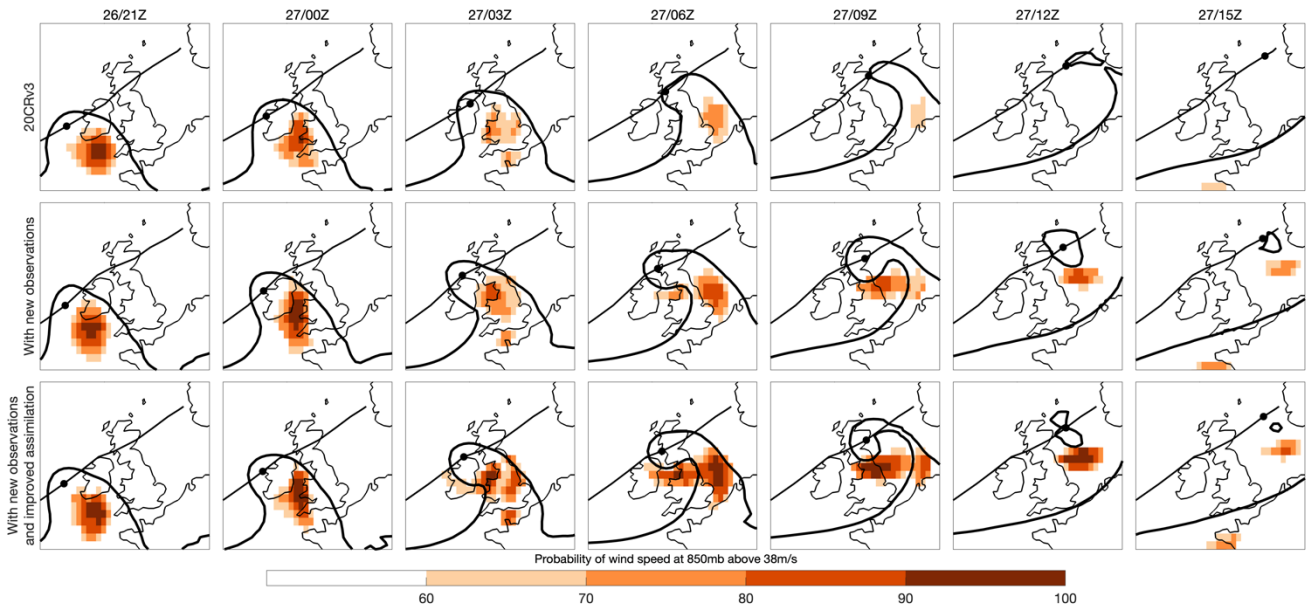
Figure S5: ensemble likelihood of wind speed at 850mb above 38ms^{-1} during Storm Ulysses. The black contour is the 284K wet bulb temperature isotherm at 850mb. The storm track is shown by the black line with solid circle representing the centre of the low pressure.
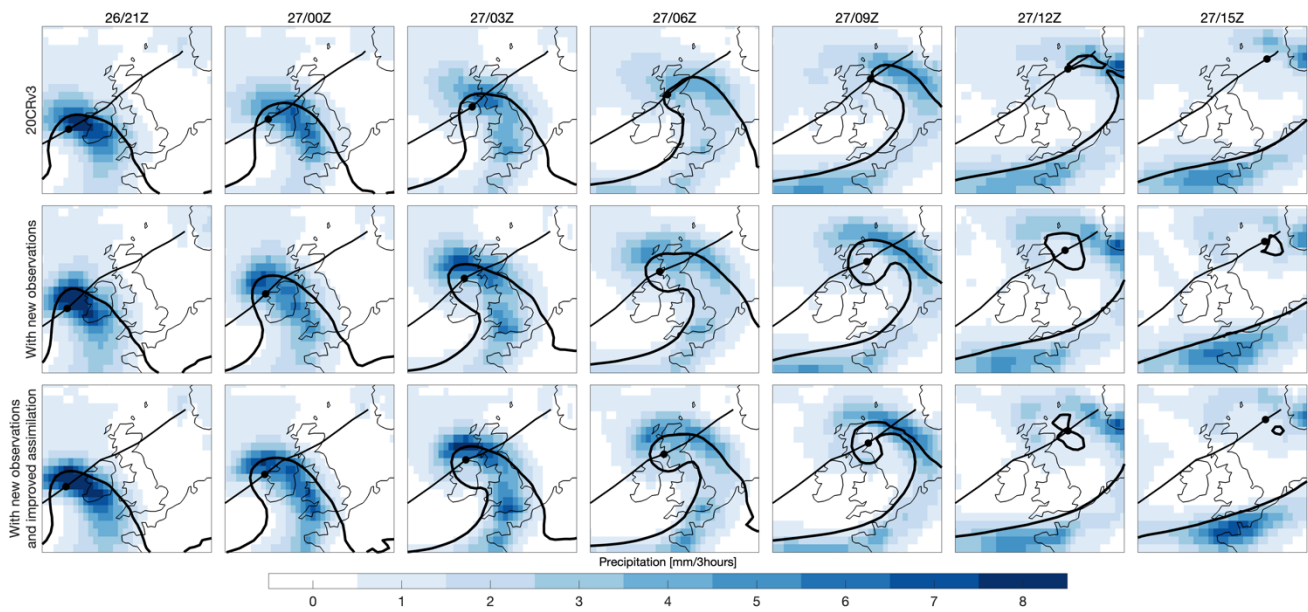
Figure S6: precipitation during Storm Ulysses (ensemble mean). The black contour is the 284K wet bulb temperature isotherm at 850mb. The storm track is shown by the black line with solid circle representing the centre of the low pressure.